IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

DENTAL MONITORING, Plaintiff, v. GET-GRIN INC., Defendant.	)	Case No: 22-647 (WCB) (CONSOLIDATED)

DECLARATION OF JOHN T. MONGAN, M.D., Ph.D. IN SUPPORT OF DENTAL MONITORING'S REPLY CLAIM CONSTRUCTION BRIEF

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1. I, John T. Mongan, have personal knowledge of the matters set forth herein and, if called as a witness, could and would competently testify thereto.

I. INTRODUCTION

2. I have been retained by counsel for Plaintiff Dental Monitoring to serve as an independent expert in this litigation and to provide opinions and testimony with respect to claim construction for U.S. Patent Nos. 11,314,983 (the "'983 patent"; D.I. 68-3) and 10,755,409 (the "'409 patent"; D.I. 68-4) (collectively the "AI Patents") as well as the state of the art and background of the AI Patents.

3. I have reviewed Grin's answering claim construction brief dated November 22, 2023, as well as the declaration of Lina Karam Ph.D. submitted on the same date in support of Grin's brief. I have also reviewed the exhibits attached to Dr. Karam's declaration, as well as the opening claim construction brief submitted by Dental Monitoring dated November 1, 2023. I have also reviewed the AI Patents and the additional materials cited below in this declaration.

4. In this declaration, I respond to certain of Dr. Karam's opinions and conclusions, as set forth below. I submit this declaration in support of Dental Monitoring's reply claim construction brief.

II. QUALIFICATIONS AND PROFESSIONAL EXPERIENCE

5. I am qualified by education and experience to testify as an expert in the field of medical imaging and to the development of machine learning or artificial intelligence models or algorithms related to medical imaging. Attached as Exhibit R-1 to this declaration is a copy of my curriculum vitae detailing my education and experience, as well as a listing of cases in which I have provided expert testimony. Additionally, the following overview of my background pertains to my qualifications for providing expert testimony in this matter.

6. I have worked as a professor in the field of radiology for 9 years, and have been involved with various aspects of informatics including machine learning, deep learning, and neural networks for the duration of my career.

7. I received a B.S. from Stanford University (1999) in Chemistry, graduating with honors and distinction. I then received a Ph.D. (2006) in bioinformatics and an M.D. (2008) from the University of California San Diego.

8. From 1995 to 2000 I worked part time as a programmer in the software testing development department of Autodesk, Inc. My work there led to three issued U.S. patents on which I am named as an inventor or co-inventor. I am the lead author of *Programming Interviews Exposed*, currently in its 4th edition. This book has sold over 100,000 copies across all editions and has been translated and republished in China (Simplified Chinese), South Korea (Korean), India (English), Russia (Russian), and Poland (Polish). During my PhD I created and contributed to several molecular simulation software applications, including AMBER, on which I am a named contributor for versions 8 through 10, and Interactive Essential Dynamics.

9. My post-graduate medical training included an internship in Internal Medicine at Kaiser Oakland Medical Center from 2008 to 2009, residency in Diagnostic Radiology at University of California San Francisco from 2009 to 2013, and fellowship in Ultrasound and Abdominal Imaging, also at University of California San Francisco from 2013 to 2014.

10. Since 2014, I have worked as a professor in the Department of Radiology and Biomedical Imaging at University of California San Francisco, initially at the assistant professor level until my promotion to associate professor in 2019. In this role, I practice abdominal radiology, including reading X-rays, CT, Ultrasound, and MRI studies; and performing image-guided biopsies and intra-operative image guidance. I train residents and fellows in radiology,

incorporating them into my clinical work, as well as delivering formal lectures on a wide range of topics with a particular focus on artificial intelligence, informatics, and physics. I also conduct grant and industry-supported research, with a focus on artificial intelligence and informatics.

11. I hold two medical board certifications: Diagnostic Radiology from the American Board of Radiology and Clinical Informatics from the American Board of Preventive Medicine. In 2022, I became a Fellow of the Society of Abdominal Radiology.

12. Since 2014, I have held leadership roles in Informatics within the Department of Radiology and Biomedical Imaging, as Associate Chair of Informatics, Vice Chair of Informatics, and Associate Chair of Translational Informatics. In these roles, I have overseen the development of a shared departmental infrastructure for AI research and translational deployment, supervised an Imaging Information Technology (IT) group of approximately 15 people responsible for the clinical computer systems used for imaging, and supervised the Scientific Computing Services IT group that manages the shared research computer infrastructure for the department.

13. I hold several university-wide leadership roles in IT and artificial intelligence, including serving since 2022 as the Chair of the IT Governance Committee on Research Technology, which provides guidance for University investment in and use of computational infrastructure for research, and serving as a member of the Artificial Intelligence Oversight Committee, which reviews artificial intelligence for clinical deployment to ensure safety and efficacy.

14. I have leadership roles in artificial intelligence and informatics in national professional societies. I have been a member since 2018 and chair since 2020 of the Artificial Intelligence Committee of the Radiological Society of North America (RSNA). The RSNA is one of the largest radiology professional societies in the world, with over 54,000 members. Under my

leadership, the Artificial Intelligence Committee has hosted artificial intelligence competitions on the Kaggle website every year. Several of these competitions have drawn approximately 1000 teams to compete. The committee also advises the RSNA board on AI position statements, endorsement of multi-society AI-related manuscripts and the development of the AI Certificate education program. I have also served on the Society of Abdominal Radiology Artificial Intelligence Emerging Technology Committee since 2020.

15. Since 2018, I have been an Associate Editor and Editorial Board Member of the peer-reviewed journal *Radiology: Artificial Intelligence* (impact factor 9.8), which focuses on application of artificial intelligence to radiology and medical imaging.

16. I have authored over 50 peer-reviewed journal articles, 17 of which are related to artificial intelligence and machine learning, and I have given over 130 lectures, including invited plenary lectures on artificial intelligence for the German Röntgen Congress and the Colombian Congress of Radiology.

17. I have completed multiple successful research projects involving development of artificial intelligence for radiology. A highlight of my research work was development of an artificial intelligence model for detection of pneumothorax. This work was published in *Public Library of Science: Medicine* (impact factor 11.6) and licensed to General Electric (GE) for incorporation into their Critical Care Suite. I worked with GE to achieve FDA clearance for the model, and it is currently commercially available on GE X-ray machines. I am the site primary investigator for a pending National Institutes of Health R01 grant that will support development of artificial intelligence for risk stratification of colorectal cancer patients for treatment planning.

18. I am currently named as an inventor or co-inventor on 3 issued U.S. patents related to computers and software.

19. For at least these reasons, and based on the additional education and experience set forth in my CV, I believe I am qualified to provide the opinions in this declaration.

III. COMPENSATION

20. I am being compensated for my time at a rate of $800 per hour. My compensation does not depend in any way on the outcome of this litigation or the particular testimony or opinions that I express.

IV. RELEVANT LEGAL PRINCIPLES

21. In forming my opinions, I have relied upon the following legal principles (summarized below) that counsel for Dental Monitoring have explained to me. I applied these principles in forming my opinions.

A. Person of Ordinary Skill in the Art

22. I have been informed that the factors to be considered in determining the level of ordinary skill in the art include: (1) the educational level of active workers in the field; (2) the type of problems encountered in the art; (3) prior art solutions to those problems; (4) the rapidity with which innovations are made; and (5) the sophistication of the technology in the art.

23. I understand that Dental Monitoring has proposed that a person of ordinary skill in the art ("POSA") as of the priority date of the '983 and '409 patents would have had a bachelor's degree or higher in computer science, bioinformatics, or a related engineering discipline, and several years of work experience relating to the development of machine learning or artificial intelligence models or algorithms. A POSA will have also worked as part of a multi-disciplinary team, which includes individuals familiar with medical imaging, dental imaging, dentistry, and/or orthodontics.

24. I agree with this definition and have applied it in formulating my opinions. I am at least a POSA because I have a Ph.D. in Bioinformatics and several years of work experience

relating to the development of machine learning or artificial intelligence models or algorithms. I have also worked as part of a multi-disciplinary team including individuals familiar with medical imaging.

25. I disagree with Grin's and Dr. Karam's definition of a POSA, which omits the statement that a POSA would have "worked as part of a multi-disciplinary team, which includes individuals familiar with medical imaging, dental imaging, dentistry, and/or orthodontics." Karam Decl. ¶ 28. To solve problems in a particular domain, it is necessary to understand all the details of the problem and the requirements of the solution. For complex problems such as those in medical and dental imaging, those details and requirements may not be easily recognized by people who lack training and experience in the clinical domain in which the problem exists. There are many examples of technically-competent individuals who were not working as part of a multidisciplinary team who created "solutions" that were technically successful but clinically useless because the problem that was solved was not the clinically relevant problem. The POSA described Dr. Karam's definition, who would not necessarily have access to clinical experience or expertise, would have little chance of success in implementing the inventions described in the AI Patents. Peer-reviewed publications have recognized the importance of a multidisciplinary team in compensating for the knowledge gaps a POSA proficient in machine learning or deep learning may have with respect to the field in which the machine learning is being applied. *See, e.g.*, Ex. R-2 (Martin-Noguerol et al., *Artificial intelligence in radiology: relevance of collaborative work between radiologists and engineers for building a multidisciplinary team* (2021)) ("there are many anatomical and biological concepts, radiological features of normal and pathological tissues, and different therapeutic options that hinder [the engineer's and data scientist's] understanding of the

target for the algorithm they are developing, and these different factors can influence the final result. For these reasons, collaborative work between this multidisciplinary team is essential").

26. The opinions I express below are not affected by my disagreement with Dr. Karam over the appropriate definition of a POSA. The opinions I express below are applicable under the POSA definition I have described, and under the POSA definition that Dr. Karam has described.

B. Claim Construction Principles

27. I understand that the parties have offered competing constructions of some of the terms or phrases in the AI Patents.

28. I understand that there are two types of claims: independent claims and dependent claims. I understand that an independent claim stands alone and includes only the limitations it recites. I further understand that a dependent claim, on the other hand, is a claim that depends on another claim, and that dependent claims include all of the limitations recited in the dependent claim as well as any limitations included in the claim(s) on which it depends.

29. I understand that, to determine the meaning of claim terms, one should first consider the intrinsic evidence, which includes the claim language itself, the patent specification, and the patent's prosecution and any post-issuance history before the Patent Office. For example, the patent specification may show that the inventor used words or terms in a manner inconsistent with their plain and ordinary meaning. Specifically, I understand that where the specification reveals a special definition given to a claim term by the inventor that differs from the meaning it would otherwise possess, the inventor's lexicography governs. I understand that the prosecution history of the patent may also provide guidance in construing a claim term. For example, the prosecution history may show that the patent applicant might have limited the scope of some or all of the claims during prosecution, either affirmatively or by implication.

30. I understand that if the intrinsic evidence is not conclusive regarding the meaning of a particular claim term, extrinsic evidence may also be used to determine its meaning. I understand that extrinsic evidence may be used, for example, to help determine what a POSA at the time of the invention would have understood the claim term to mean. Extrinsic evidence may include, for example, dictionaries, technical treatises, journals, articles, or expert testimony.

V. CLAIM CONSTRUCTIONS ISSUES IN THIS CASE

31. Below is a listing of claim terms of the AI Patents that I understand to be in dispute and for which I am offering opinions in response to Dr. Karam's declaration. The table below lists the parties' respective positions as to these terms.

Term	Dental Monitoring's Construction	Get-Grin's Construction
Deep learning device '983 Patent claims 1, 2, 3, and 12 '409 Patent claims 1, 3, 7, and 15	A device that, through training, is capable of analyzing an image and recognizing patterns therein.	A device that employs a deep neural network to classify data after being trained on an input dataset
Neural network '983 Patent claims 1 and 12 '409 Patent claim 15	Plain and ordinary meaning ("One or more AI algorithms that employ layers of nodes, with weighted connections between the layers, that perform pattern recognition.")	A set of AI algorithms that employ layers of nodes, with weighted connections between the layers, and are used to perform pattern recognition and classification
Creation of a learning base '983 Patent claims 1 and 12 '409 Patent claims 3 and 7	Plain and ordinary meaning ("creation of a collection of images and corresponding attribute values for those images")	Acquiring images and identifying and storing attribute values for acquired images to create a database to be used in the training of the Deep Learning Device

A. Deep Learning Device

32. I understand that Dental Monitoring's position is that the term "deep learning device" should be construed to mean "a device that, through training, is capable of analyzing an image and recognizing patterns therein." It is my opinion that this construction is consistent with

the intrinsic evidence of the AI Patents and I agree with this construction. In particular, the AI Patents disclose that "[t]hrough its training in the step 2), the deep learning device is capable of analyzing the analysis image and of recognizing said patterns therein." '983 patent, 16:56-58; *see also id.*, 17:40-32 (same).

1. The "deep learning device" does not necessarily "employ[] a deep neural network."

33. Reading the AI Patents, a POSA would understand, from both the structure of the claims and the specification, that a neural network is a preferred embodiment of a "deep learning device" disclosed in the AI Patents, and is not required for the "deep learning device." For example, claim 1 of the '409 Patent recites analyzing an image using a "deep learning device" but it does not recite the use of a neural network. *See* '409 Patent, claim 1 ("analysis of the analysis image by means of a deep learning device"). Later, dependent claim 15 of the '409 Patent recites "[t]he method as claimed in claim 1, in which ***the deep learning device is a neural network***") (emphasis added). A POSA, reading these two claims together and taking into account the specification, would understand that a "deep learning device" does not necessarily require a "neural network." The specification indicates that a "neural network" is but one preferred embodiment of a "deep learning device." *See, e.g.*, '983 patent, 16:14-15 ("In step 2), a deep learning device, preferably a neural network, is trained with the learning base").

34. I disagree with Dr. Karam's unsupported assertion that a POSA would understand the phrase "a deep learning device, preferably a neural network," as used repeatedly in the specifications of the AI Patents, to indicate an embodiment of the invention where the deep learning device "is a neural network without additional functionality." Karam Decl. ¶ 39. If the applicant wanted to convey, as Dr. Karam appears to hypothesize, that the preferred embodiment consisted solely of the neural network, the applicant could have phrased it as "deep learning device,

preferably solely a neural network" or "deep learning device, preferably consisting of only a neural network."[1] The phrasing employed here, "deep learning device, preferably a neural network," indicates to a POSA that "deep learning device" represents a broader class of which a "neural network" is a member. Therefore, a POSA would understand that "deep learning device" is a broader class of algorithms, the characteristics of which are described in the specification and of which a neural network is a member. *See* '983 Patent, 16:56-58.

35. Furthermore, a POSA would understand that when the AI Patents refer to "a neural network," they refer to neural networks that may *include* additional functionality, thereby undermining Dr. Karam's assertion that "the language 'preferably a neural network' … indicate[s] an embodiment of the invention where the deep learning device is a neural network *without* additional functionality." Karam Decl. ¶ 39 (emphasis added). In particular, the AI Patents specify that "[t]he neural network may in particular be chosen from," followed by a list of neural networks, including, for example, the "R-CNN" neural network. '983 patent, 16:18-45. A POSA would know that the "R-CNN" neural network contains additional functionality. Specifically, a POSA would know that "R-CNN" comprises not just a convolutional neural network, but also a region proposal algorithm as well as class-specific linear support vector machine algorithms (SVMs). *See* Ex. R-3 at Fig. 1 (Donahue et. al., *Rich feature hierarchies for accurate objection detection and semantic segmentation* (Oct. 22, 2014)) ("[o]ur system (1) takes an input image, (2) extracts around 2000

[1] Indeed, the applicant knew how to use limiting language elsewhere in the AI Patents. For example, with another preferred embodiment, the specification of the AI Patents reads: "[a] tooth attribute is preferably an attribute which ***only*** relates to the tooth modeled by the tooth model." '983 Patent, 8:19-21 (emphasis added). There is no analogous limiting language in the specification of the AI Patents with respect to "deep learning device." *E.g.*, '983 Patent, 1:24-25 ("a deep learning device, preferably a neural network). This indicates to a POSA that the preferred embodiment of "deep learning device" is not limited to only "neural networks" without additional functionality.

bottom-up region proposals, (3) computes features for each proposal using a large convolutional neural network (CNN), and then (4) classifies each region using class-specific linear SVMs"). Therefore, a POSA would understand that the phrase "neural network" in the context of the AI Patents may refer to neural networks with "additional functionality."

36. Many of the most effective "deep learning devices" are "neural networks" with "additional functionality". Examples include "deep learning devices" that comprise components which, by themselves, could independently be considered "neural networks," paired with "additional functionality" in the form of support vector machines.[2] A POSA would still commonly refer to these "deep learning devices" as "neural networks," despite the presence of "additional functionality." Indeed, the applicants do so in the specification of the AI Patents. *See* '983 Patent, 16:18-39 (referring to R-CNN as a "neural network"). Therefore, a POSA would understand the phrase "preferably a neural network" to refer to neural networks, independent of whether or not such networks include "additional functionality."

37. I also disagree with Dr. Karam that a POSA would understand dependent claim 15 of the '409 patent, which recites "[t]he method as claimed in claim 1, in which the deep learning device is a neural network," to be limited to a neural network without additional functionality. Karam Decl. ¶ 43. For the same reasons explained above, a POSA would understand dependent claim 15 to include neural networks with additional functionality, such as R-CNN. A POSA would

[2] *See, e.g.*, *supra* ¶ 35 (describing the R-CNN "neural network" referenced in the specification, which comprises a convolutional neural network and a support vector machine), Ex. R-4 (Xiong et al., *A good practice towards top performance of face recognition: transferred deep feature fusion* (Apr. 3, 2017)) (describing state of the art performance on facial recognition challenges using multiple convolutional neural networks paired with linear support vector machines); Ex. R-5 (Tang, *Deep learning using linear support vector machines* (Feb. 21, 2015)) (demonstrating "a small but consistent advantage" in pairing neural networks with support vector machines).

also understand that claim 15 narrows claim 1 because in claim 1, the "deep learning device" is not limited to those embodiments that use a neural network.

38. Dr. Karam points to the language of claim 1 of the '983 patent, which recites in part "submission of the analysis image to ***a neural network*** … B) training of at least one ***deep learning device***, by means of the learning base; C) submission of the analysis image ***to said at least one deep learning device***." Karam Decl. ¶ 37 (citing '983 patent, claim 1). Dr. Karam asserts that "[a] POSA would understand from this that the method of submitting the image to a neural network is accomplished by submitting the image to a deep learning device that uses a neural network." *Id.* I agree with Dr. Karam that the deep learning device as recited in that claim must include a neural network because the claim recites "submission of the analysis image to a neural network."

39. However, Dr. Karam does not explain how or why this claim language demonstrates that a "deep learning device" must always "employ[] a deep neural network," as is required by Grin's construction, even in the case of patent claims that recite "deep learning device" but do not recite "neural network." Karam Decl. ¶ 37; *e.g.,* '409 Patent, claim 1. A POSA would understand from the specification that "deep learning device" has multiple embodiments, and that a neural network is a preferred embodiment. *See, e.g.*, '983 Patent, 16:13-14 ("a deep learning device, preferably a neural network"). Further, a POSA would understand that in claim 1 of the '983 patent, the "deep learning device" takes this preferred embodiment because the claim explicitly recites "submission of the analysis image to a neural network". '983 Patent, claim 1. Therefore, I disagree with Dr. Karam to the extent she relies on claim 1 of the '983 patent, which recites both "deep learning device" and "neural network," to support a requirement that recitation of "deep learning device," without additional recitation of "neural network," requires a "neural network." For example, claim 1 of the '409 patent recites "analysis of the analysis image by means of a deep

learning device" but does not recite any claim limitations relating to "neural networks." '409 Patent, Claim 1.

40. I disagree with Dr. Karam that the File History of the AI Patents shows that "deep learning device" must necessarily include a neural network. Karam Decl. ¶ 40. Dr. Karam cites the Notice of Allowance for the '983 patent in which the Examiner wrote "[t]his invention relates generally, to a method for analyzing an image … a method in which the analysis image is submitted to a ***deep neural network***." Ex. 1 at DENTAL647-00017617 (emphasis added). A POSA, reading the whole patent and File History, would not understand this to imply that all "deep learning devices" necessarily employ "neural networks." Instead, a POSA would recognize that the Notice of Allowance uses the phrase "deep neural network" when describing the invention because both independent claims of the '983 patent (claims 1 and 12) specify "submission of the analysis image ***to a neural network***." A POSA would recognize that the Notice of Allowance for the '409 patent contains different language that does not require a neural network: "[t]his invention relates generally, to … a method in which the analysis image is submitted to a ***deep learning device***." Ex. R-6 at DENTAL647-00018623 (emphasis added). A POSA would understand this to be the case because, unlike the '983 patent, the independent claim of the '409 patent (claim 1) does not recite—and thus does not require—a neural network. Therefore, by comparing and contrasting the claims and File Histories of the AI Patents, and by reviewing their common specifications, a POSA would understand that the phrase "deep learning device," without more, does not necessarily require a neural network.

41. Dr. Karam also appears to rely on the reference titles cited on the face of the AI Patents to argue that deep learning requires a deep neural network, because the references contain the phrases "deep neural network" or "deep convolutional neural network" in their titles. Karam

Decl. ¶ 41. In my opinion, a POSA would not conclude, from reading two of those titles, that a "deep learning device" as recited in the claims of the AI Patents necessarily requires a neural network. This is because the context in which "deep learning device" is used in the specification of the AI Patents indicates that its meaning is broader than just the neural networks described in the cited references.

42. I disagree with Dr. Karam's reliance on the extrinsic evidence. Karam Decl. ¶ 42. The intrinsic evidence is clear and a POSA would be able to adequately understand what the AI Patents refer to when the AI Patents recite "deep learning device." Dr. Karam herself concedes that "extrinsic evidence may not be used to contradict the intrinsic evidence." Karam Decl. ¶ 9.

43. Furthermore, Dr. Karam appears to misread one of the references, quoting not the definition of "deep learning" but rather a passage that comes after the definition. *Id.* (citing Ex. 2 (Meriam Webster)). The actual definition, which reads "a form of machine learning in which the computer network rapidly teaches itself to understand a concept without human intervention by performing a large number of iterative calculations on an extremely large dataset," supports a construction of deep learning device which does not require neural networks. Ex. 2 (Meriam-Webster). Instead of citing the definition, Dr. Karam appears to quote one of three example sentences, choosing the only example sentence that mentions neural networks. Karam Decl. ¶ 42. The other two sentences make no mention of neural networks. Ex. 2 (Meriam-Webster) ("[d]eep learning involves feeding machines lots of data so the Al can learn patterns itself without requiring humans to program knowledge into the machine"; "[t]he purpose of many deep learning systems is to minimize the amount of time spent feeding or quizzing a piece of software").

44. In her concluding paragraph, Dr. Karam mischaracterizes Dental Monitoring's construction: "DM's argument that a 'deep learning device ***does not use*** a neural network is

incorrect …". Karam Decl. ¶ 45 (emphasis added). Dental Monitoring's construction allows a "deep learning device" to be a neural network—it simply does not require that a "deep learning devices" include a neural network.

2. The "deep learning device" does not necessarily "classify data."

45. I disagree that a "deep learning device" always "classif[ies] data." Dr. Karam appears to argue that all convolutional neural networks ("CNNs") perform classification, such that all deep learning devices which contain convolutional neural networks also perform classification. Karam Decl. ¶¶ 49-50 ("[T]he first set of examples provided are convolutional neural networks (or CNNs), which the patent explains specialize in the classification of images. … A POSA would understand that the 'R-CNN' and 'Faster R-CNN' perform classification because they employ, as their names indicate, CNNs"). This is not correct.

46. A POSA would know that not all "deep learning devices" perform classification—they can perform other, non-classification tasks including but not limited to feature extraction and regression. The specifications of the AI Patents disclose such "deep learning devices," and therefore a POSA would understand that a "deep learning device" does not necessarily have to be used "to classify data," as would be required under Grin's construction.

47. One task, other than classification, that a "deep learning device" can perform is feature extraction—the process of transforming raw data into a more manageable and meaningful form. It is a way of extracting more meaningful data from raw data, not a method for classifying data.

48. Feature extraction is commonly a prerequisite step to classifying data. For example, to determine whether some part of an image is a tooth, a POSA may first use a CNN to extract the salient features of the picture (*i.e.*, blobs, textures, edges, corners, or even specific object shapes such as facial features). Then a POSA can use another algorithm, which may or may not be a neural

network, to analyze the extracted features and reach a classification. This is analogous to analyzing a crime scene, wherein a detective may first extract salient features from the suspects such as fingerprints, footprints, and alibis (feature extraction) and then use the extracted features to classify the suspects into categories such as "arrest" and "do not arrest" (classification).

49. Indeed, one of the examples Dr. Karam discusses first uses a neural network to perform feature extraction, and then uses another algorithm to analyze the extracted features and classify data. In "R-CNN," the CNN is used to perform feature extraction—not image classification. Ex. R-3 at Fig. 1 (explaining that "[the 'R-CNN'] computes features for each proposal using a large convolutional neural network (CNN)"). The classification step is not handled by a neural network, but rather by support vector machines, another machine learning algorithm. *Id.* ("[the 'R-CNN'] classifies each region using class-specific linear SVMs").

50. As a further example, a POSA would know that "deep learning devices" can also be used to perform regression, which predicts continuous values, as opposed to classification, which sorts data into discrete categories. For example, a "deep learning device" which analyzes a picture and indicates whether the picture contains a picture of a cat is performing classification. However, a "deep learning device" which analyzes a picture and estimates the height of the pictured cat would be performing regression.

51. The specification cites neural networks—which are examples of deep learning devices—that perform regression. Specifically, the "Faster R-CNN" neural network uses a technique called bounding box regression. Ex. R-7 at 3 (Ren et al., *Faster R-CNN: towards real-time object detection with region proposal networks* (Jan. 6, 2016)) (describing a "box-regression" method). Similarly, the "SSD" neural network also uses regression to compute the location of objects on an image. Ex. 7 at 7 (Liu et al., *SSD: Single Shot MultiBox Detector* (Dec. 29, 2016))

(describing the advantages of SSD because "SSD can localize objects better because it ***directly learns to regress the object shape*** and classify object categories instead of using two decoupled steps) (emphasis added).

52. Therefore, the specifications of the AI Patents disclose exemplary neural networks—which are non-limiting examples of deep learning devices—that do not classify data. Accordingly, a POSA would understand that a "deep learning device" does not necessarily classify data.

53. Furthermore, I note that Dr. Karam's declaration purports to enumerate examples of neural networks that perform classification. Karam Decl. ¶¶ 47-50. Examples of *some* "deep learning devices" which perform classification do not prove that *all* "deep learning devices" must perform classification.

54. Dental Monitoring is not arguing, as Dr. Karam appears to believe, "that a 'deep learning device' does not classify data." Karam Decl. ¶ 52. Rather, Dental Monitoring's construction recognizes that a "deep learning device" should not be limited to classifying data because a POSA would understand that a "deep learning device" can be used for other, non-classification tasks, and the specifications disclose examples of "deep learning devices" which do precisely that.

B. Neural Network

55. I understand that Dental Monitoring's position is that the term "neural network" should be construed to mean "[o]ne or more AI algorithms that employ layers of nodes, with weighted connections between the layers, that perform pattern recognition." It is my opinion that this construction is consistent with the intrinsic evidence of the AI Patents and I agree with this construction.

56. I disagree with Dr. Karam's and Grin's requirement that a "neural network" always "[be] used to perform … classification." To support this proposition, Dr. Karam points to examples in the specification of "neural networks" performing classification. Karam Decl. ¶ 55 ("a POSA would understand that the AI Patents' claims and specification read together show that a neural network performs classification"), ¶ 56 ("the References Cited on the face of the AI patents show that a POSA would have understood a neural network … to perform classification"). However, as noted above, examples of *some* "neural networks" that perform classification does not establish that *all* "neural networks" must perform classification.

57. I also disagree that a "neural network" must "perform … classification" for the reasons discussed above in Section V.A.2 of my declaration. In short, because the specifications in the AI Patents disclose neural networks which do not classify data, a POSA would understand that a "neural network" does not necessarily classify data. While Dr. Karam's declaration provides assertions about what a POSA would understand a "neural network" to be and examples of "neural networks" performing classification, her declaration offers no evidence for why a neural network ***must*** perform classification. Karam Decl. ¶¶ 53-56.

58. I agree with Dr. Karam that "[a] POSA would understand that classification of data is ***a*** function of a neural network," Karam Decl. ¶ 59 (emphasis added), in that neural networks may classify data. I disagree with Dr. Karam to the extent she argues that classification of data is ***the only*** function of a "neural network," because a POSA would be aware of the neural networks referenced above and would know that those neural networks do not classify data. Dr. Karam also erroneously inverts the causation when she asserts that "in order to recognize patterns, neural networks perform classification." *Id.* It is the other way around: neural networks recognize patterns

and, based on those patterns, are able to both extract features, perform regression, and/or perform classification. *See supra* ¶¶ 45-52.

59. The AI Patents' disclosures of "neural networks" used for feature extraction and regression support Dental Monitoring's construction and demonstrate that Dr. Karam's analysis is erroneous. The existence of these "neural networks" which perform pattern recognition, but do not classify data, show that while pattern recognition is a necessary part of a "neural network", data classification is not.

C. Creation of a Learning Base

60. I understand that Dental Monitoring's position is that the term "creation of a learning base" should be construed to mean "creation of a collection of images and corresponding attribute values for those images." It is my opinion that this construction is consistent with the intrinsic evidence of the AI Patents and I agree with this construction.

61. The "learning base" comprises images to which at least one attribute value has been assigned. *See, e.g.*, '983 patent, Fig. 4, 15:65-16:3 ("In the step 1), a learning base is created comprising more than 1000, preferably more than 5000, preferably more than 10 000, preferably more than 30 000, preferably more than 50 000, preferably more than 100 000 historical images. The greater the number of historical images, the better the analysis performed by the method."), 16:6-16:13 ("The learning base may however be constructed according to other methods, for example be created manually. To create a historical image of the learning base, an operator, preferably an orthodontist, identifies one or more "historical" tooth zones on an image, called ["historical tooth zones" and] then assigns, to each identified historical tooth zone, a value for at least one tooth attribute."), 16:47-53 ("In the step 2), the deep learning device is preferably trained by a learning process called "deep learning". By presenting, as input for the deep learning device, historical images (images+descriptions), the deep learning device progressively learns to

recognize patterns on an image, and to associate them with tooth zones and with tooth attribute values, for example tooth numbers."); *see also id.*, 1:33-38 ("1) creation of a learning base comprising more than 1000 images of dental arches, or "historical images", each historical image comprising one or more zones each representing a tooth, or "historical tooth zones", to each of which, for at least one tooth attribute, a tooth attribute value is assigned"), 3:23-26 ("Alternatively, the deep learning device may be used globally, the learning base containing historical images whose description provides a global attribute value for the image.").

62. The AI Patents disclose numerous embodiments of "creation", including preferred embodiments (*see* '983 patent, Figs. 2-3, 2:4-3:3, 7:44-48 ("A detailed analysis method according to the invention requires the creation of a learning base. This creation preferably implements a method comprising the steps A) to F), or, in one embodiment, in place of the steps A) to C), preferably the steps A') to C').")) and alternative embodiments (*see* '983 patent, 15:26-33 ("In one embodiment, the learning base is created by an operator. The latter thus analyzes thousands of analysis images. For the learning base to be able to be used for the implementation of a detailed analysis method, it determines the tooth zones, then assigns them tooth attribute values. For the learning base to be able to be used for the implementation of a global analysis method, it assigns image attribute values to each image. It may thus form historical images."), 15:65-16:3[3]). The AI Patents state, "[i]n one embodiment, the learning base is created by an operator." '983 patent,

[3] ("In the step 1), a learning base is created comprising more than 1000, preferably more than 5000, preferably more than 10 000, preferably more than 30 000, preferably more than 50 000, preferably more than 100 000 historical images. The greater the number of historical images, the better the analysis performed by the method. Preferably, a learning base is used that is enriched according to an enrichment method according to the invention. The learning base may however be constructed according to other methods, for example be created manually. To create a historical image of the learning base, an operator, preferably an orthodontist, identifies one or more "historical" tooth zones on an image, called then assigns, to each identified historical tooth zone, a value for at least one tooth attribute.")

15:26-27. This is, however, only one way that the learning base may be created, and the "learning base may however be constructed according to other methods." '983 patent, 16:6-7.

63. Therefore, a POSA at the time of the invention would understand "creation" as a broad act consistent the word's plain and ordinary meaning, and no construction is needed for this term. I disagree with Dr. Karam's apparent opinion that a POSA would understand "creation," as recited in the claims of the AI Patents, to specifically require the various steps of "acquiring," "identifying," and "storing." Karam Decl. ¶¶ 63-65. The AI Patents are clear that there are multiple ways to "create" a learning base.

64. A POSA would understand that a learning base could be created by compiling or collecting images and annotation data from online resources. This would not require the step of individually identifying image attribute values. Therefore, I disagree with Dr. Karam's conclusory statement that "creation of a learning base" necessarily requires performing the three steps of "acquiring," "identifying," and "storing" as set out in Grin's proposed construction. *See* Karam Decl. ¶¶ 63-65.

65. I disagree with Dr. Karam's assertion that "Grin's proposed construction is consistent with the claim language." Karam Decl. ¶ 62. The independent claims of the AI Patents uniformly recite "creation of a learning base" but do not recite steps of "acquiring images and identifying and storing attribute values for acquired images," as proposed by Grin. *See* '409 Patent, claim 1; '983 Patent, claims 1 and 12.

66. If anything, the claims of the AI Patents refute Dr. Karam's opinion and would lead a POSA to reject Grin's construction. The dependent claims of the AI Patents recite methods of creating a learning base that further require the additional steps specified in Grin's proposed construction. *See* '983 Patent, claim 6 (reciting "acquisition", "identification", and "addition of the

updated image … in the learning base", which is analogous to "storing"), claim 7 (same); '409 Patent, claim 8 (same), claim 9 (same). The fact that these steps are not specifically recited every time the AI Patents recite "creation of a learning base" would lead a POSA to understand that "creation of a learning base" does not necessarily require these specific actions.

67. I also disagree with Dr. Karam's assertion that "[Grin's] construction is supported by the claims, specification, a knowledge of a POSA as well as the extrinsic evidence." Karam Decl. ¶ 61. Grin's construction requires a "database." A database has specific meaning to a POSA (data organized and stored in a format that software can efficiently retrieve subsets and aggregated representations of the data in response to queries). Grin's construction adds this limitation to creation of a learning base with no support in the patent, nor supporting evidence in Dr. Karam's declaration.

68. Grin's construction for "creation of a learning base" appears to improperly exclude actions that are not done with the intent of "training of the Deep Learning Device." That is, under Grin's construction, if an entity were to acquire images, and identify and store attribute values for the acquired images to create a learning base with the intent of using it for some reason other than "the training of the Deep Learning Device," that would not constitute "creation of a learning base"—even if the entity later decided to use the "learning base" to train the deep learning device. Nothing in Dr. Karam's declaration supports such a restrictive construction of "creation of a learning base." In fact, the specifications of the AI Patents never specify an intent requirement on the act of "creation of a learning base." Grin's construction is untenable because a POSA would understand that a learning base could be made with multiple purposes in mind, and that the applications to which a learning base is applied could change over time. A POSA would not

understand that "creation of a learning base" requires, at the time of creation, that the learning base be created specifically for the training of the recited deep learning device.

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I declare under penalty of perjury under the laws of the United States that the above is true and correct.

Executed on this 5th day of December 2023 in San Francisco, California.

John T. Mongan, M.D., Ph.D.